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ABSTRACT

It is important that new methods and techniques be developed that will improve the quality of instruction and, at the same time, make it available to all students, whether advanced, disadvantaged, or removed physically from centers of learning. This report describes a computer-assisted instruction (CAI) laboratory, beginning with an introductory explanatory section on CAI, and then briefly considering the Laboratory's history, objectives, staff, and highlights. Appended are a summary of CAI programs at Penn State, descriptions of CAI courses available at Penn State, and a CAI bibliography. (Author/SH)

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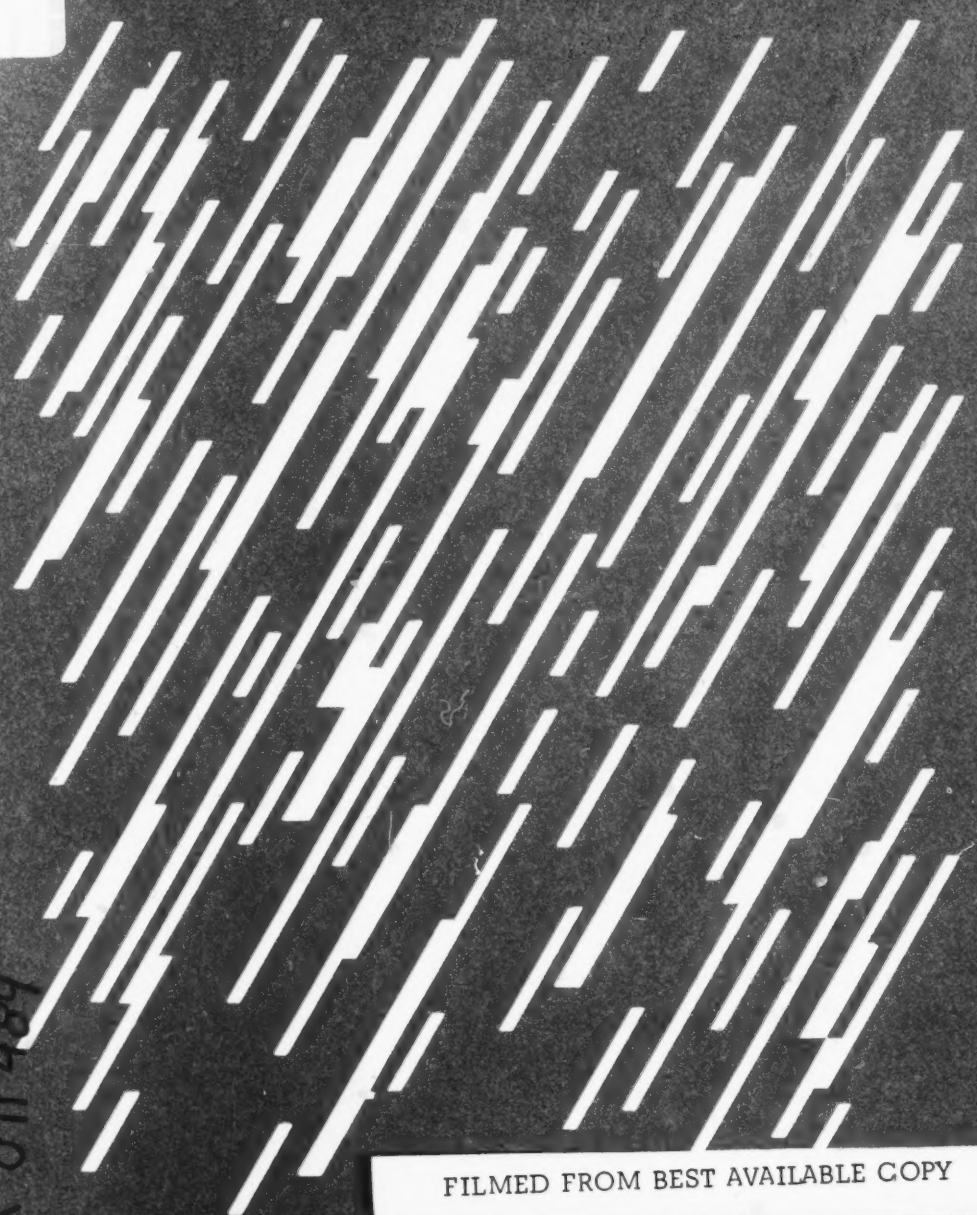
THE COMPUTER ASSISTED INSTRUCTION LABORATORY
THE PENNSYLVANIA STATE UNIVERSITY

Report No. R-55

Computer Assisted Instruction at Penn State

F. D. Dimmick, ed.



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THE COMPUTER ASSISTED INSTRUCTION LABORATORY

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COMPUTER ASSISTED INSTRUCTION AT PENN STATE

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Report No. R-55

The Pennsylvania State University

Computer Assisted Instruction Laboratory

April, 1973

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Computer Assisted Instruction At
Penn State

Errata

Page 4 – *The first sentence recorded on Page 4 under the topic THE NEED FOR IMPROVED INSTRUCTION should read as follows:*

For some time educators have agreed that instruction, if it is to be successful, must not be directed toward a mass of students gathered in some lecture hall.

Page 17 – *The first column recorded as MISCELLANEOUS FUNDS on Page 17 should be titled PROJECT.*

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INTRODUCTION

Because of the rapid increase in school enrollment, the fantastic expansion of knowledge, and the demand by the bill-paying public for economical yet sound educational practices, educational institutions are confronted with a multi-faceted dilemma that requires utilization of new and better teaching techniques. This problem has been a growing one for several decades and the educational specialists have emerged with many interim solutions—everything from the mass lecture to broadcast television—in an attempt to cope with the problem.

Although each medium has its obvious strengths and weaknesses, most are coming under increasing attack by educators who feel that the learning process is not nourished to the extent that it should be. Thus, we too often have a medium that only enables an institution to group hundreds of students and hopefully lower the educational cost. Unfortunately, even though the cost in dollars has been decreased, the wasted student time and the less-than-acceptable learning is a cost that our society cannot afford.

It is important that new methods and techniques be developed that will improve the quality of instruction and, at the same time, make it available to all students, whether advanced, disadvantaged, or removed physically from centers of learning. We must have available, now, instructional techniques that will provide relief from standard teaching methods and yet have the capacity to include the fast-rising number of students clamoring for education.

The newest technology to appear, and one that promises to open this door to efficient, low cost, and sound education, is computer-assisted instruction. Computer-assisted instruction (CAI) is just now entering its second decade of development, and so far has shown itself to be a most promising medium for improving the educational process. Because adequate data for evaluation requires time and because the development of techniques and hardware must preceed utilization, the concept is still young and not totally proven. The future, however, seems to be bright.

COMPUTER-ASSISTED INSTRUCTION

What is CAI?

In simple terms, computer-assisted instruction is a means of teaching students the contents of a course or a series of courses through progressive units electronically manipulated by a computer. It is one of the most recent advances in instructional technology and represents the first major application of an eminent technology since the advent of broadcast television as a teaching tool in the late '40s. Through the use of CAI, a student can successfully complete an entire course by interacting with only the computer controlled media during instruction. By using the computer, the student is able to receive a course that is individually adapted to *his* learning requirements, i.e., *his* speed, *his* learning aptitude, and many other variables. This instruction may be tutorial in nature, be a problem simulation, consist of drill and practice, be a purveyor of information or be a combination of the four types. The computer-assisted instruction course itself has two components: an instructional program and a computer program.

The instructional program is developed by competent curriculum specialists who determine the instructional material and specify the contingencies for sequencing the presentation of material in the course. The computer program mediates the presentation of the instructional program to the student.

Each student interacts with the computer through several computer-controlled devices at a student station. Each student station is equipped with a small cathode ray tube (CRT) on which is displayed alphameric information plus a wide variety of graphics including animated illustrations. Sufficient

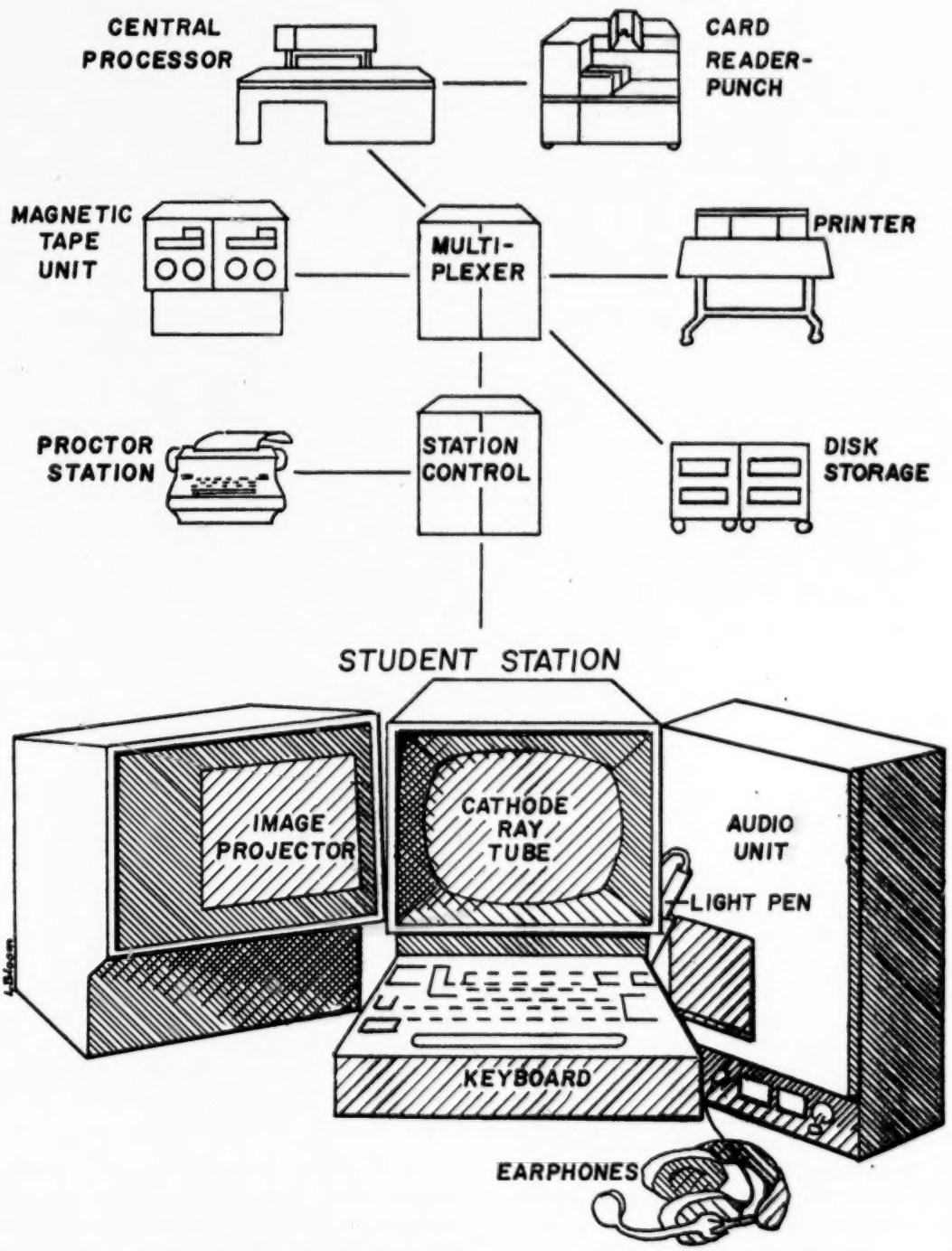

Figure 1. Configuration of the IBM 1500 Computer Assisted Instruction System With One of the 32 Student Stations

information to fill the CRT is available in micro-seconds from a random-access disk. Student response components of the CRT include a typewriter-like keyboard with upper and lower case characters plus a wide variety of special characters and a light-sensitive pen used by the learner in making responses to displayed material. In addition to the CRT, each student station has a rear-screen image projector on which are displayed color photographic images from a 1020-frame, 16mm film with each frame randomly accessible by the computer. The third display component is an individual audio play/record device with randomly accessed, pre-recorded messages on standard ¼-inch audio tape. Branching and individualizing teaching strategies have been introduced into the courses to the extent that the present state-of-the-art supports inclusion of these techniques.

The students interact at the terminals with a teaching program which has been prepared and tested by the members of the faculty of The Pennsylvania State University, in cooperation with the staff of the Computer Assisted Instruction Laboratory. In addition to the program of instruction stored in the computer, each student may be required to use a textbook, a handbook, and appropriate tools.

When the student completes a course, he takes a final examination generated by the computer from a pool of test questions covering the objectives of the course. A complete record of each participant's performance, not only on the test, but on the course as well, is recorded on magnetic tape for summarization, marking, and course improvement by the authors.

Since the computer has the capability to record and recall student responses, the number of right or wrong answers, and so on, the sequence of instruction for a particular student can be altered on the basis of his responses. More challenging material or remedial instruction may be presented on the basis of past performance, or sections of the course may be skipped if the student's level of performance is at specific level of proficiency. And if the student stops interacting with the computer for a period of time while taking a course, when he signs on again the instruction will resume exactly where he stopped.

The computer can be used to record a variety of types of information for all students, e.g., the exact contents of his response, the number of seconds he takes to respond, and his exact position in a course. Summary information such as number of correct responses to a question, total number of response attempts, etc., may be produced for analysis by the instructor.

In the present stage of development, CAI systems may accommodate as many as 150-200 instructional stations simultaneously. Conceivably, students at these stations could all be on different courses simultaneously (Butler, 1969).

To develop and present courses, the computer system utilizes several devices. The central processing unit, or CPU, is the nerve center of the computer and directs the activities of all other components. A disk unit is used to house the disks on which course information is stored magnetically. Information anywhere on the disks can be reached in less than one and one-half seconds, thus making rapid course execution possible. These disks are interchangeable; therefore, it is possible to have any number of courses available in a disk library.

Why All The Fuss About CAI?

Computer-assisted instruction is one more development in the long continuum of learning aids. Like books, films and records, it multiplies instruction and extends the reach of mediocrity as well as excellence (Hausman, 1967). There are a number of advantages to this instructional system, however: 1) The machine never loses its ability to repeat information as long as necessary for the student to grasp it; 2) It is a private system, i.e., each student works on a one-to-one relationship with the computer. The result is that no student is forced to proceed at a rate too fast or too slow for his ability and no student need be reluctant to respond; 3) It allows for a course to be presented that is authored by a collection of authorities in the field who pool their knowledge and abilities to produce a top-notch course available to many more people than the few who could attend any seminar these experts might sponsor; 4) It provides instant and complete records of each student's development; 5) It, by the very nature of tracking and branching, insures the acquisition of basic skills for students who may be educationally deprived, and makes them more teachable as they progress; 6) It relieves the teacher from the day-to-day humdrum of constant remedial instruction, so that she may carry on with what she does best—introduce new material and act as diagnostician.

History of CAI

Sidney Pressey in the early 1900s and B. F. Skinner in 1954 provided the earliest attempts to "automate" instruction. Both Pressey and Skinner developed techniques of administering instructional material to students by means of teaching machines or through programmed texts. It was soon discovered, however, that programmed texts and teaching machines were extremely limited in the extent to which they could adapt to individual differences among students or provide a stimulating responsive environment for students. The obvious limitations of these devices prompted the investigation of applying computers to instructional tasks.

In 1959, researchers at IBM developed a course to teach stenotype and binary arithmetic by computer. One of the inherent problems in the early development of computer-assisted instruction was that this computer system and most systems at that time were built around modified business computers which were not appropriate for instructional purposes.

After much research effort, IBM announced, in 1966, the development of the 1500 Instructional System. Although several prototype models were delivered earlier, the first production-line model was delivered and installed in December 1967. The 1500 was the first computer system which was designed and built specifically for instructional purposes. Systems developed in the late 1950s and early 1960s used either an electric typewriter or a teletype terminal as an interface device by which the student received information from the computer and through which he transmitted information to the computer. The 1500 system, which was designed specifically for instructional purposes, as well as others designed since 1967, utilizes a television-like screen as the major display device, along with the optional projector and audio unit. The television screen has graphic and animation capabilities.

THE NEED FOR IMPROVED INSTRUCTION

For some time educators have agreed that instruction, if it is to be successful, must be directed toward a mass of students gathered in some lecture hall. It is generally known that each student brings to the learning experience a diverse background demanding that instruction, if it is to be meaningful, be tailored to his individual requirements. Background greatly affects the ability and capability of each student to such an extent that it is assumed that, ". . . if the quality of learning is dependent upon a large number of variables, then it would be improbable that any two persons would be ready for the same instruction from the same media at the same time" (Mitzel, 1970). It seems, then, that we must fit the subject matter presentations to the individual requirements of the learner so that what is unique or special about every learner, that may affect his achievement, will be taken into consideration

Early attempts at adapting instruction to the needs of the learner resulted in an interim solution known as individual instruction. This instruction merely allowed students to work individually through a programmed text or audio/visual presentation in a lock-step fashion that resulted only in pacing students and not considering individual differences other than speed. On the other hand, ". . . individualized instruction suggests that something unique about the learner has been taken into account in a dynamic way to build an instructional sequence" (Mitzel, 1970).

The simple, yet important act of purveying information is also in dire need of improvement. Lecture halls are sadly lacking; instructional television seems not to be the answer; and the long-time stand-by, the textbook is, in itself, not an acceptable medium to present material to an unmotivated student.

CAI AS IMPROVED INSTRUCTION

We here at Penn State feel that the computer offers to educators the best possibility to date for meeting this instructional crisis that appears large on the educational scene. We are deeply involved in finding the best ways to use the computer as a teaching tool that will not only save precious time and money, but will, more importantly, provide the best education possible for the greatest number of individuals.

Types of CAI

When one begins to think about computer-assisted instruction, it soon becomes evident that there are several types of CAI that can be considered as instructional. In considering the concept of CAI, then, it is important to differentiate between the different applications of the computer which are collectively referred to as computer-assisted instruction.

The first of these applications is the use of a computer as a laboratory computing device. This use, which is perhaps the most common in education, is the type where a single terminal is placed in a laboratory with direct access to a computer at some remote location. The students are allowed to develop programs as they are related to the course(s) which they are taking (Hall, 1970).

Secondly, the computer, used as a management tool, a record keeper and retriever, is used primarily by faculty members and administrators for batch processing data regarding students, instruction and school management (Countermine, 1973). The computer schedules classes, prints report cards, stores and retrieves test results (Hall, 1970), maintains inventories and even distributes new equipment (Garner and Dimmick, 1971).

A third form of CAI can be defined as simulation with the computer responding adaptively to learner input. A great deal of work in this application of computers to instruction has been done in the field of medicine. Sim One (Abrahamson, Wolf and Denson, 1969) is a life-like device having a plastic skin which resembles a human's in color and texture. Sim One exhibits vital signs and responds to several drugs and gasses. The physiologic responses are in real time and occur automatically as part of a computer program. At Bolt, Beranek, and Newman, Inc. (Feurzeig, 1968), a computer has been programmed to simulate the conditions of a patient brought into a hospital emergency room. A physician in training sits down at a teletype terminal and by requesting information, tests, and symptoms from the computer regarding his "patient," is able to eventually provide a diagnosis of the specific injuries that the "patient" has received. An even more elaborate diagnostic simulation program is under development at the University of Illinois Medical School at Chicago.

CAI also makes the computer a tutor (Harless, 1969), providing drill and practice problems for students at a terminal with the most complex being that of sequential exposition which provides the primary source of instruction for the student. In this latter form, a complete course is presented by means of a computer (Hall, 1970).

We feel that using the computer most closely simulates the ideal instructional situation, i.e., a one-to-one relationship between instructor and student, for CAI has the flexibility and capacity for individualizing instruction which is necessary for the adaptive education that a wide variety of learners requires.

There are three fundamental characteristics of computer applications in instruction which suggest that significant steps in improving instruction can be achieved through the utilization of computers. The first characteristic of computer-assisted instruction is the active responding by the student. This characteristic is quite important for the slower learner. A properly prepared child may learn by reading through a textbook or other printed material. The unmotivated child simply needs the active response to and the feedback from the computer program.

A second characteristic is the ability of a program in the computer to evaluate the student's responses and provide information regarding these responses. This allows feedback tailored to the ability level of each student, regarding his responses; whether he be the most advanced or the poorest student. It also indicates that the poorest student still received feedback regarding his work at the minimum of once per minute, while in a regular classroom, this same student, governed by his reticence, may respond and receive feedback only two to three times per week. This individual attention and individual responsibility tend to motivate even the more reluctant pupil.

A third feature of the computer's ability as an instructor is its individualization of instruction not only at the level of achievement but in reference to the specific interests and abilities of the student. The computer can keep a record of the student's performance and progress through a course and alter that course based upon the immediate past history of the individual student in studying that subject matter. This dynamic characteristic of CAI makes it possible to begin considering not the passage of time nor the covering of a specific text nor doing a given number of problems as criteria for progressing through the curriculum, but the opportunity to base student assessment upon the mastery of predetermined

criterion levels (Hall, 1970). Thus, each pupil takes a "branching" route through his course with his exact path depending upon his own successes in each stage. No pupil is allowed to persist in practice that is too easy for him or to suffer repeated failure in lessons that are too difficult.

An important side advantage of using the computer is its ability to keep the teacher constantly informed of the progress being made by each student. At the same time, besides informing the teacher of the progress of each pupil, the system also has the capacity to deliver periodic reports on the progress of the class as a whole, thus enabling the teacher to make necessary changes in her plans, methods, etc.

The Research To Date

A consistent finding through all of the studies is that CAI has produced at least as much learning as conventional instruction and, in most cases, has produced more learning than conventional instruction. Considerable savings in time have also been shown where this variable has been investigated. Although direct comparison between studies are hazardous because of the differing objectives of the studies, differing student characteristics, and differing content characteristics, there appears to be an increase in the performance level of the CAI program tracing from the early drill and practice programs to the later tutorial programs. This improvement in performance could be attributed to the improved skill of curriculum development and also the improved performance of computer systems. As more sophisticated computer systems (both hardware and software) become available, the full range of these flexibilities will be employed in most curricula (Hall and Mitzel, 1973).

The Effects Of CAI On The Role of the Teacher

Invariably, when one begins to speak of a new or an improved technology to aid the educational process, an outcry arises relative to what this innovation will do to the status of the present teacher. Some believe that a newer technology, such as CAI, is a "flash-in-the-pan" and will die out if left alone. Others become upset because of fear that they will be replaced by a computer, and their defense mechanism puts forth arguments to school boards that are often quite convincing.

In actual experience to date, it has been seen quite clearly that the computer and CAI do not replace the present teacher, but merely rearrange her priorities. With CAI handling drill and recitation, the teacher can do what a teacher does best: develop new concepts. CAI will take away the drudgery of rote teaching; a consistently endless time and energy draining technique. It is during this time that the teacher is freed to act as diagnostician; to help individuals with problems. Also, the computer, used as an administrative tool, will virtually eliminate the teacher's acting as a human data processing machine, i.e., inventorying, grading papers, counting heads, scheduling, etc. This technology allows teachers to concentrate their attention on the personally human concerns of their students. Teachers can spend time on the higher order activities of motivating pupils, diagnosing learning handicaps of individuals, and prescribing appropriate and effective remedial instruction. Released from their normal repetitive tasks, they can now facilitate such activities as group meetings in which students discuss their hopes, fears, dreams, and anxieties. Teachers can help students in their struggle to resolve value issues and conflicts and overcome feelings of alienation, powerlessness and self-doubt. Teachers can help students set meaningful goals, order their priorities and make important personal and social decisions (Canfield, 1971).

The Costs

Now that we've talked about what CAI will do, perhaps we should spend time justifying the cost, for surely anything that involves a computer will be expensive. To date, the apparent costs of CAI are not too different from the range of costs for conventional instruction. Fully-operational systems today can run approximately $3.00 per student hour to operate. If one were to determine the cost of an operational CAI system by considering the dedicated (after instruction) usage and the time/shared (instruction) usage and then apply the resultant formulas to the operating costs and debt retirement, the rate for a student station would range from $0.78 to $0.92 per hour. After the system is purchased and the debt is retired, the cost per student hour of instruction is only $0.22!

When one looks at the cost of CAI, he must take into account three areas of potentiality which may affect the probability of acceptance. First is the comparison of CAI to the cost of other modes of instruction. Three dollars per student hour is not as expensive as other modes of instruction such as remedial instruction, vocational instruction, or homebound instruction. Neither is it high when one thinks of allowing the people termed as uneducable to remain so.

Secondly, there is the fact that while the costs of technology required to produce and maintain CAI are steadily decreasing, the costs of conventional education are soaring. The increasing number of personnel and the increasing cost of this staff suggests that schools should very seriously consider modern educational technology as an alternate approach for meeting some of their goals.

The third potentiality is the fact that a computer installed as an instructional tool may well be adapted for administrative duties, e.g., after hours use as a scheduler, grade reporter, bookkeeper, etc. On this basis alone the cost of a CAI system could be justified. It is also this use which helps make the cost of CAI, as an instructional tool, inexpensive.

Student Attitude

It seems obvious that one would expect that student attitude toward the method of instruction will play an important role in both the acquisition of and the transfer of learning. A student with a more favorable attitude will probably be inclined to learn more and to apply what he has learned to other situations.

Because CAI is what one would consider a different learning environment, it is important for researchers to determine what the attitude of CAI students is toward the medium.

The Student Opinion Survey (SOS), a 42 item questionnaire, was developed at The Pennsylvania State University (Brown, 1966) and was adapted for CAI administration (Borman, 1969). The survey deals with statements about student attitudes toward CAI, the operation of the equipment, the content of the course, and general feelings about the learning situation. Students respond by indicating the degree to which they agree (ranging from strongly agree to strongly disagree) with a statement of the extent that they thought the statement applied (ranging from all of the time to never). Student responses are scored on an 8 point scale, with 8 indicating the most favorable attitude and 1 indicating the least favorable attitude. Students may also type free-response comments after each statement. SOS is administered to students in the CAI groups immediately following completion of their course work. By considering the range of possible scores on the SOS (a product of the 1-8 scale times the number of questions), it is possible to construct an attitude toward CAI scale with the higher total score indicating a more favorable student attitude.

Several studies to date, using the SOS, indicate an overwhelming preference for the CAI course over traditional courses primarily because of the convenience of this method and the constant interaction in the learning process (Vitello, Sedlak, Peck, 1972). SOS is also valuable in gauging improvements to the course content, the instruction, and the media (Sedlak, Borman, Cartwright, 1972).

It must be remembered, however, that although preliminary information is favorable, adequate data will not be available until students have been exposed to CAI over a number of years in varying subject matter.

Figure 2. A Typical Student Station in the CAI Laboratory at University Park

THE COMPUTER ASSISTED INSTRUCTION LABORATORY

AT

THE PENNSYLVANIA STATE UNIVERSITY

History

The CAI Laboratory at Penn State was established in 1964 with one typewriter terminal teleprocessing to an IBM facility at Yorktown Heights, New York. Soon after, another terminal and audiovisual equipment were added. This "system" was replaced in January 1965 with a connection to a computer at the Computation Center on Penn State's University Park Campus. During the life of this second system, four student stations were located in the State College Area Schools, four in Chambers Building, two at Roosevelt Junior High School, Altoona, and one at the Naval Medical School in Bethesda, Maryland. These terminals to the IBM 1410 system remained operable until June 1968.

An IBM 1500 instructional system was installed in Chambers Building in December 1967. Thirty-two student stations are presently being used at the main University Park Laboratory. Each student station consists of a Cathode Ray Tube (CRT) with a keyboard and light pen. Each station also includes an image projector and audio device for playing messages for the student and recording his messages.

Penn State's CAI Objectives

The four primary objectives on which the Laboratory is focusing its attention and efforts are:

1. Effects of technology on the learning process;
2. Development of CAI curriculum materials for new educational systems;
3. Computer systems development and research;
4. Resident instruction of both undergraduate and graduate students in regularly-scheduled courses.

Staff

A specialist staff of 31 full-time members are working on projects within the Laboratory. In addition to these, there are 11 part-time faculty members who represent three departments within the College of Education. The Laboratory supports 10 Graduate Assistants from four departments in the College of Education. The work of this staff is augmented and supported by a clerical staff of seven and a systems staff of six.

Highlights

Although CAI is still in its infancy and there is much research and development ahead, the staff at Penn State has completed and made available to various populations complete courses which can be taken via CAI.

Cooperating with The School Districts of Philadelphia and Pittsburgh, and the State Department of Education, the Penn State staff has developed a complete ninth grade general mathematics course and a ninth grade algebra course. The students receive the administered course from their teachers (who aided in the development) by way of CAI and receive off-line enrichment materials by way of conventional instruction.

The staff at the Penn State Laboratory has also devoted considerable time and effort in developing inservice teacher education programs. In February 1969, Penn State mounted an inservice education program in three locations in rural Appalachia (Hall, *et al.* 1970). A complete computer system with 16 student stations was moved into three different rural communities. The system was installed and made operational with a program in modern mathematics for elementary teachers. In three settings, the program served 387 educators.

In a continuing effort to support the educational needs of inservice teachers, Penn State is presently making available to teachers a CAI course in the early identification of handicapped children (Cartwright and Cartwright, 1970). The course, called CARE (Computer-Assisted Renewal Education), is a completely self-contained, three-credit, college course which deals with the identification of handicapping conditions in children. Further CARE courses are currently being developed, including the diagnostic teaching of preschool and primary children and the education of visually and aurally handicapped children.

In order to make courses available to as many inservice teachers as possible, Penn State has outfitted a custom-designed expandable mobile van which houses a complete IBM 1500 instructional system (Figure 3, Figure 4). The van contains 560 square feet when expanded, and contains 16 student stations at which inservice teachers and supervisors take the offered courses. The van, with the CAI system, can be pulled by diesel tractor to a location and set up for instruction in a short period of time. The mobile CAI system is located in an area for a six- to eight-week period adjacent to a centrally-located school building. Teachers then take the course at their convenience during the evenings or weekends. The mobile facility can serve up to 150 teachers during the six- to eight-week stop.

We feel that mobile CAI is a new and innovative concept in inservice teacher education. The impact of the course is maximized by the fact that mobile CAI permits the course to be disseminated to large numbers of teachers who reside in different parts of the United States.

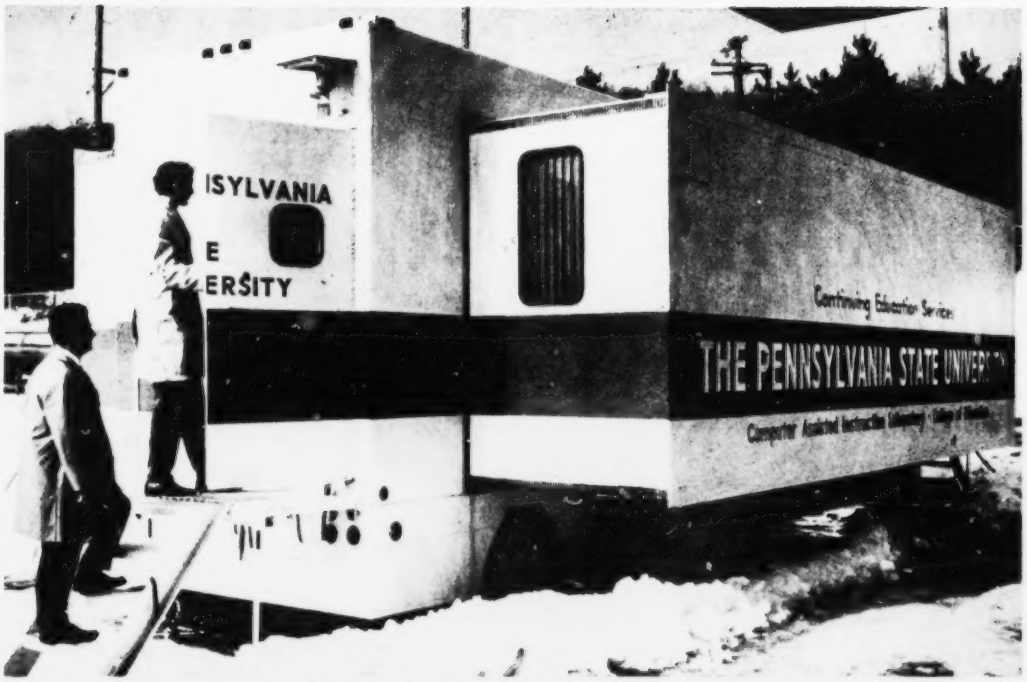

Figure 3. Exterior View of the Mobile CAI Laboratory

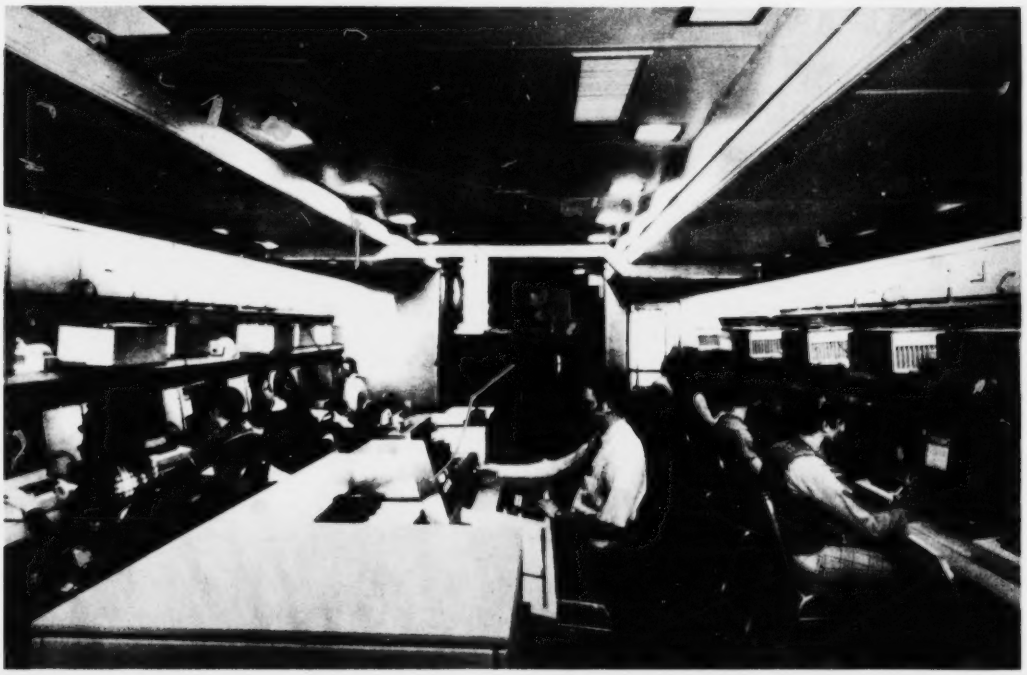

Figure 4. Interior View of the Mobile CAI Laboratory

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APPENDIX A

SUMMARY OF PENN STATE PROGRAMS IN CAI

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Miscellaneous Funds	Duration	Support
CAI Feasibility Study for Four College Courses	4/01/64 - 6/30/67	U.S.O.E., Title VIII Bureau of Research
Experimentation with CAI in Technical Education	6/01/65 - 6/30/69	U.S.O.E. Vocational Ed. Act 1963 Bureau of Research
Development of Pilot Computer-Based Vocational Information	1/01/66 - 6/30/68	Pennsylvania Department of Public Instruction
Random vs. Ordered Sequencing in Computer Assisted Instruction	6/10/66 - 3/31/67	U.S.O.E., Title VII NDEA
Inservice Training in Modern Math for Elementary Teachers	8/01/66 - 6/30/67	Williamsport (Pennsylvania) Public School (Title III ESEA)
Development and Evaluation of CAI in Instrumental Music (Clarinet)	6/28/67 - 9/30/69	U.S.O.E., Bureau of Research
Development and Evaluation of CAI Course in Recognition of Malaria Parasites	5/01/67 - 6/30/68	U.S. Naval Medical School
Development and Programing of Simulated Pure Tone Audiometer	7/01/67 - 12/31/68	U.S.O.E. Development of Handicapped Children and Youth
Use of CAI to Teach Spelling to Sixth Graders	7/01/67 - 6/30/68	College Area Schools Title III ESEA
Commonwealth Consortium to Develop, Implement, and Evaluate a Pilot Program of Computer Assisted Instruction in Urban High Schools	3/16/68 - 7/30/71	U.S.O.E. Pittsburgh School District Title III
Development Operations and Evaluation of a Modern Mathematics Course for Inservice Education of Elementary School Teachers	2/01/69 - 9/22/69	U.S.O.E., Appalachia Educational Laboratory, Inc., Title III
Development of a Computer-Assisted Course in the Identification and Diagnosis of Handicapping Conditions in Children	6/01/69 - 5/31/71	U.S.O.E., Bureau of Education for the Handicapped
A Study of Paradigms for the Development and Evaluation of CAI Programs	6/01/69 - 10/15/71	National Science Foundation
Summer Institute for Teachers of Computer-Assisted Instruction Courses in Pittsburgh	6/12/69 - 8/29/69	U.S.O.E., Bureau of Educational Personnel Development

Miscellaneous Funds	Duration	Support
Spanish Translation of a CAI Course	2/02/70 - 9/30/70	U.S.O.E., Bureau of Research
Development of a Test for the Nonperforming Aspects of Music Education	3/02/70 - 11/01/70	U.S.O.E., Bureau of Research
Mobile Inservice Special Education Instruction for Education in Sparsely Populated Areas	3/16/70 - 4/15/73	U.S.O.E., Bureau of Educational Personnel Development
Development of a Model for the Teaching of Beginning Shorthand Through the Use of Computer Assisted Instruction	4/01/70 - 10/15/71	U.S.O.E., Bureau of Research
Review of CAI in Pennsylvania	5/01/70 - 6/30/70	Pennsylvania Department of Education Service
The Interaction Between Reward Preference and Task Difficulty in a Computer Assisted Setting	6/01/71 - 11/30/71	U.S.O.E., Bureau of Research
Evaluation of Computer Assisted Instruction in Instrumental Musicianship	11/15/71 - 8/15/72	U.S.O.E., Bureau of Research Region III
A Computer-Assisted Literacy Development Program for Career Oriented Youth and Adults	1/01/72 - 6/30/73	U.S.O.E., National Educational Research and Development Program
Training Early Childhood Educators: Computer Assisted Instruction Courses in Diagnostic Teaching	1/10/72 - 1/09/74	U.S.O.E., Bureau of Education for the Handicapped
Pilot Study of CAI Cardiology Program	1/01/72 - 9/30/72	Pennsylvania Medical Society
A Computer-Assisted Course in the Education of Visually Handicapped Children for Rural Regular Classroom Teachers	6/01/71 - 8/31/72	University of Pittsburgh and U.S.O.E.

APPENDIX B

CAI COURSES AVAILABLE AT PENN STATE

ADMINISTRATION

BUDGE

BUDGE is a utility course which maintains budgets and performs necessary accounting procedures and manipulations. The program accepts input from both data card and, when available, the IBM 1510 cathode ray tube (CRT) terminal. The program renders daily, automatically-selected hard-copy reports for fund accounts at different levels, and summary reports for CRT display.

DEMONSTRATION

HOWTO

HOWTO is a short, general segment written to teach a student how to use the IBM 1500 System's student station. The student is taught:

1. to identify the 1510 cathode ray tube, the 1512 image projector, and the 1506 audio listening unit;
2. to respond using the keyboard;
3. to erase a keyboard response;
4. to respond using the light pen;
5. to sign on; and
6. to sign off.

WELCO

WELCO (Welcome to CAI) is a demonstration program written to give a newcomer to CAI a general idea of some of the programs available via the Penn State system. It is preceded by a short lesson on how to use the student station, including the 1510 cathode ray tube, the 1512 image projector, and the 1506 audio listening unit.

The user may choose short segments from the following list of topics: Mathematics For Elementary School Teachers; Tic-Tac-Toe Game; Algebra Drill; Estimation Game; Multiplication Drill; Graphics Sampler; Slide Rule Course; Biology; Music; Educational Measurement.

EVALUATION

SOS

SOS (Student Opinion Survey) is a 42-item questionnaire administered on-line following a CAI course's final examination. The survey deals with statements about student attitudes toward computer-assisted instruction, the operation of the equipment, likes and dislikes of the course, and student's feelings in general about the learning situation. It has been adapted to on-line administration and has been modified to allow a student to type free response comments after each item so that he may clarify or explain his reason for a particular answer.

Students evaluate statements by depressing the light pen along a coded line on the cathode ray tube to indicate the degree to which they agree ("strongly agree" . . . "strongly disagree") with an indication of the extent that they thought the statement applied ("all of the time" . . . "never").

Students can also type comments up to 200 characters in length after each of the 42 statements in the questionnaire, giving them the opportunity to fabricate their own, individual comments.

MUSIC

MUSIC is a course in instrumental musicianship which concentrates on articulation, phrasing, and rhythm. It consists of aural-visual discrimination training and presents exemplary models for intermediate-level, trebel clef instrumentalists. It is coordinated with a related off-line practice program in which students implement the aural concepts in their performance. The course program makes use of the 1510 cathode ray tube, the 1512 image projector, and the 1506 audio listening device.

LANGUAGE ARTS

BOWL

BOWL is a short (approximately one hour) special purpose course designed to teach the scoring of bowling. The course was designed to be appropriate for junior high and secondary level students who have reading problems. The vocabulary load is low, syntax is simple, and explanations are quite concrete. There is a significant amount of branching to assist the student in acquiring difficult concepts and there is considerable practice imbedded in the program.

The course utilizes the 1510 cathode ray tube only.

ITA

ITA is a short course designed to provide inservice teachers with a knowledge of the Initial Teaching Alphabet (ITA). The course, lasting approximately two to three hours, enables teachers to transliterate from ITA and to ITA. The course utilizes the 1510 cathode ray tube, the 1512 image projector, and the 1506 audio listening device.

LITE

The Computer Assisted Literacy Development Program for Career Oriented Youth and Adults (LITE) is a course of instruction which is prepared to achieve two broad goals:

1. LITE is designed to increase literacy levels of illiterate and semi-literate youth and adults. Material develops comprehension, vocabulary, and syntactic work skills at a variety of reading levels.
2. LITE also provides career information through reading content to assist the learner in preparing for the job world. It supplies job, task, and technical descriptions of a variety of occupational categories.

LITE is written to utilize the 1510 cathode ray tube, the 1512 image projector, and the 1506 audio listening device.

PHONI

PHONI is a training course in phonics content, phonics analysis techniques, teaching methods and principles for preservice elementary school teachers.

The course, lasting an average of eight hours, is preceded by a pretest which enables the student to pass by superfluous instruction or practice.

The segment areas are: Readiness for Phonics; Consonant Blends; Consonant Digraphs; Syllabication; Single Vowel Letter-Sound Relationships; Vowel Combinations; Digraphs and Dipthongs; Consonant Irregularities; and Vowel Irregularities.

Brief illustrative lessons provide the preservice teacher with one model for introducing letter-sound relationships to children. Different phonics content are used to point out the procedural steps and principles.

The course is programmed to make use of the 1510 cathode ray tube, the 1506 audio listening device, and the 1512 image projector.

MATHEMATICS

ALGEB

ALGEB is an individually-adaptive Algebra 1 course developed for urban ninth grade students. The course material includes numbers and set notation; properties of equality and operations; integers (properties and operations); operations with rational and real numbers; equations; nequalities and problem solving; linear systems; polynomials; and factoring polynomials.

The on-line material is organized into instructional blocks, each lasting approximately 20 minutes, which contain a preskill test; instructional material; practice material; off-line assignments; a summary, emphasizing the main points of the instruction; an option to review any part of the block; and a criterion-referenced out-quiz.

The course utilizes the 1510 cathode ray tube and the 1512 image projector.

GENMA

GENMA is a general mathematics course developed for urban ninth grade students. The general mathematics course includes instruction in equations; negative integers; division of whole numbers, decimals, and fractions; ratio and proportion; percent; formulas; geometry; measurement; and graphing.

The on-line material is organized into instructional blocks, each lasting approximately 20 minutes, which contain a preskill test; instructional material; practice material; off-line assignments; a summary, emphasizing the main points of instruction; an option to review any part of the block; and a criterion-referenced out-quiz.

The course uses the 1510 cathode ray tube and the 1512 image projector.

MATHED

The CAI course MATHED is designed to present both mathematical content and teaching methods for that content to both elementary teachers and university students who are preparing to teach in the elementary schools. The primary purpose of the program is to make available the mathematical content and the strategies and techniques necessary to develop a successful program in the elementary school.

The course utilizes the 1510 cathode ray tube and the 1512 image projector.

SLIDE

SLIDE provides CAI instruction in the use of a slide rule. Segments show the student how to use these scales to multiply and divide. The course, which utilizes the 1510 cathode ray tube and the 1512 image projector, is designed for anyone over the age of ten years who is interested in learning to use a slide rule.

A short course, SLANS, allows a student to check his answers to the off-line problems that appear in the booklet provided with the slide rule course.

SPECIAL EDUCATION

CARE 1

CARE 1, *Early Identification of Handicapped Children,* is a course designed and written to give educational personnel the knowledge and skills necessary to deal effectively with children who have educational problems; it is appropriate for teachers of all grade levels but is aimed primarily at preschool and elementary school teachers. The course is also designed to be of interest to other educational personnel as well.

The CARE 1 course prepares inservice preschool and primary level elementary teachers and other interested persons to know the characteristics of, and be able to identify handicapped children.

CARE 1 is currently used on the University Park Campus as EEC 400, a three-credit, graduate-level, resident instruction course. It has also been made available to several other universities throughout the United States and Canada.

The course is written for use with the 1510 cathode ray tube, the 1512 image projector and the 1506 audio listening device.

CARE 2
CARE 3

CARE 2, *Diagnostic Teaching of Preschool Children,* and CARE 3, *Diagnostic Teaching of Primary Children,* are designed to teach regular preschool and primary teachers, aides, child care workers, and child development associates how to work effectively with children who have learning problems because of learning disability, mental retardation, cultural disadvantage, and/or emotional disturbance.

The courses make extensive use of the 1510 cathode ray tube, the 1512 image projector and the 1506 audio listening device.

CARE 2 is to be used on the University Park Campus as EEC 401 beginning September 1973. EEC 401 is to be a three-credit, graduate-level, resident instruction course.

CARE 4

CARE 4, *Education of Visually Handicapped Children,* is designed to equip regular classroom teachers with the knowledge and skills necessary to manage the instruction of visually handicapped children, both those who have partial vision and those who are blind, in regular classes with normally seeing children.

Course material has been selected with rural teachers in mind, but the material is also appropriate for inservice teachers and school personnel in other settings as well as for preservice teachers.

Students who complete CARE 4 should be able to identify educationally relevant characteristics of visually handicapped children, construct instructional objectives for these children, select suitable media and materials for instruction, arrange proper classroom environmental conditions, design instructional procedures to facilitate learning, and utilize appropriate techniques for evaluating the performance of visually handicapped children. CARE 4 is also being used at the University Park Campus of Penn State as EEC 496, a one-credit, graduate-level, resident instruction course.

CARE 4 makes extensive use of the 1510 cathode ray tube, the 1512 image projector and the 1506 audio listening device.

AUDIO

AUDIO is a 12-18 hour CAI course which deals with the anatomy, physiology and diseases of the human ear. The program, which represents approximately one-third of the University's Speech Pathology and Audiology 430 course, includes a considerable amount of branching and is supported with audio-presented materials and slides of diagrams, audiograms, anatomical drawings, etc. The course makes extensive use of the 1510 cathode ray tube, the 1512 image projector and the 1506 audio listening device.

THE PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF EDUCATION
201 CHAMBERS BUILDING
UNIVERSITY PARK, PENNSYLVANIA 16802

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NOTE: Reports R1 through R17 are available on microfilm reel only.

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